"PROGNOSTIC VALUE OF HYPONATREMIA IN PATIENTS WITH ACUTE CORONARY SYNDROME"

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Submitted to

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

CHENNAI

CERTIFICATE

This is to certify that this dissertation entitled **"PROGNOSTIC VALUE OF HYPONATREMIA IN PATIENTS WITH ACUTE CORONARY SYNDROME"** submitted by Dr.G.ARAVIND to the faculty of General Medicine, The Tamil Nadu Dr.M.G.R Medical University, Chennai in partial fulfillment of the requirement for the award of M.D degree Branch I (General Medicine) is a bonafide research work carried out by him under my direct supervision and guidance.

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DECLARATION

I, Dr.G.ARAVIND, solemnly declare that Dissertation titled **"PROGNOSTIC VALUE OF HYPONATREMIA IN PATIENTS WITH ACUTE CORONARY SYNDROME"** is a bonafide work done by me at Government Royapettah Hospital, Chennai, during April 2016 to September 2016 under the guidance and supervision of Prof.Dr.S.Mayilvahanan, M.D., Professor of Medicine, Government Royapettah Hospital,, Chennai. I also declare that this bonafide work or a part of this work was not submitted by me or any other for award degree or diploma to any other university, board either in India or abroad.

This dissertation is submitted to the Tamilnadu DR. M.G.R Medical University, towards partial fulfillment of requirement for the award of M.D. Degree (Branch – I) in General Medicine.

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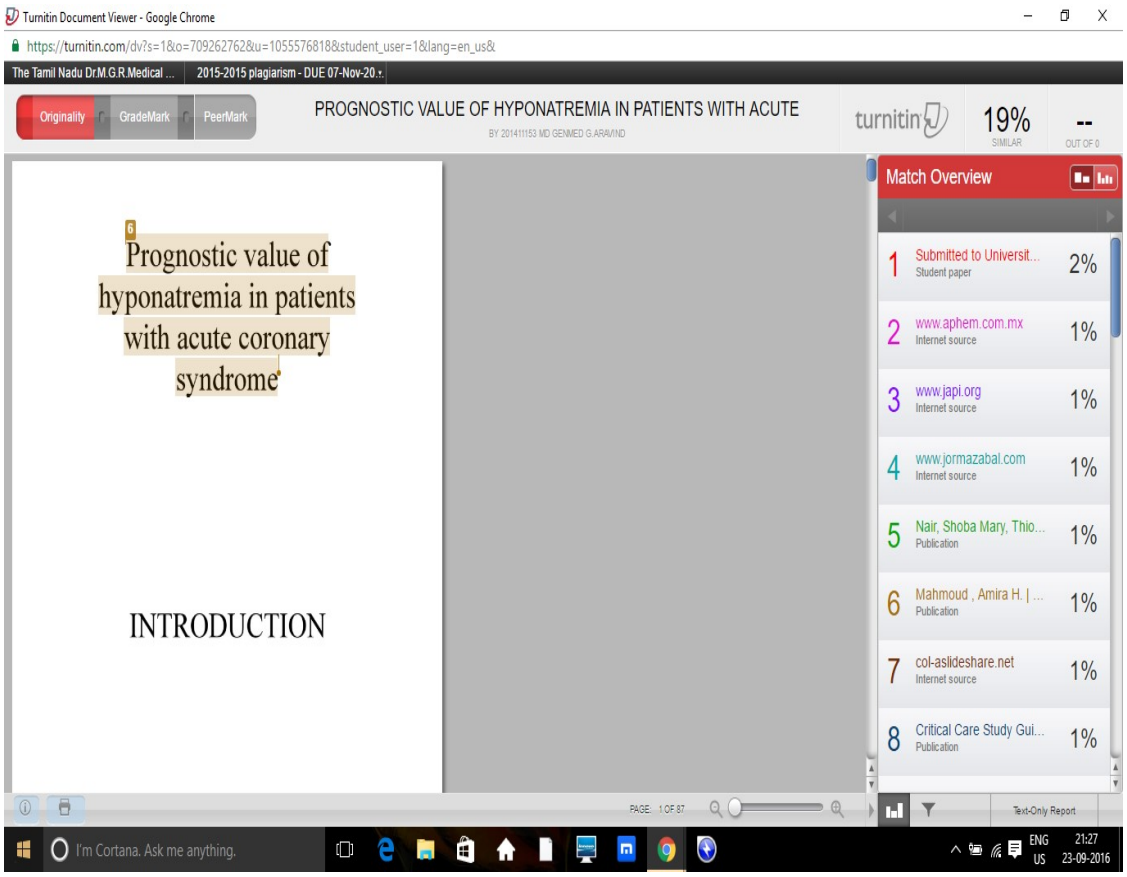

CONTENTS

INTRODUCTION

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Coronary artery disease is the leading cause of mortality globally accounting for roughly 7 million deaths[92] and 129 million DALYs[92] annually. Coronary artery disease exerts a significant economic toll , accounting for one third of a projected 47 trillion dollars[92] in economic losses to noncommunicable diseases for the next 20 years[92].

India has the greatest burden of Acute Coronary syndromes in the world. The CREATE registry has provided data on 20,648 patients from 89 centres from 10 regions and 50 cities in India[82].

Indian patients with ACS usually have higher incidence of ST-segment elevation myocardial infarction (61%) than patients in high income countries(20%)[82].

The 30 day outcome in STEMI were 9% death, 23% reinfarct, 0.8% shock. In non ST-segment elevation myocardial infarction 30 day outcome was 3.7% mortality, 1.2% reinfarct, 0.3% shock[82].

However a study from Vellore (Tamil Nadu)[12], provided data on in hospital mortality rates among South Indian population with ST-segment elevation myocardial infarction(STEMI) to be around 17%.

Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients with heart failure[18,19]. In fact, the neurohumoral activation that accompanies acute myocardial infarction is similar to that which accompanies heart failure[20].

Hyponatremia is common after myocardial infarction(MI), and clinical improvement is accompanied by a rise in plasma sodium concentration[22] . However, while the prognostic value of hyponatremia in chronic heart failure is well established [18], data on the prevalence and prognostic importance of hyponatremia in the setting of acute myocardial infarction are lacking[22]

Golberg et al[66] in their study of 978 patients have concluded that early hyponatremia is a simple marker of neurohumoral activation during acute phase of MI and predicts the long term development of heart failure and death[64].

Hence we designed a study to determine the prognostic significance of hyponatremia in the setting of Acute coronary syndrome and to determine its usefulness in predicting short term mortality (30 day outcome)[93].

AIMS OF THE STUDY

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1. To study the prevalence of hyponaetremia in patients with Acute coronary syndromes.

2. To analyse prognostic significance of hyponaetremia in patients with Acute Coronary Syndromes.

3. To access usefulness of hyponaetremia in predicting short term mortality.

4.To find association between hyponaetremia and other risk factors like Ejection fraction, Hypertension, Diabetes mellitus, Smoking, Type of infarction.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Coronary artery disease is the leading cause of mortality and morbidity in the world and Acute coronary syndromes (ACS) , which encompass Unstable Angina(UA), Non-ST segment elevation myocardial infarction, ST-segment elevation myocardial infarction, are the commonest causes of mortality in Coronary artery disease[95-100].

ACS in Indians occurs 5-10 years earlier than in other populations around the world and the major effect[101] is on the productive workforce of the country aged 35-65 years. India has the highest burden of ACS in the world[82].

The rising incidence of ACS in Indians[101] may be because of lifestyle modifications, western food practices, increasing incidence of Diabetes mellitus and probably genetic factors too[101].

Asian Indians , usually have higher incidence of coronary artery disease in comparison to other ethnic groups. Coronary artery disease in Asian Indians tends to be more severe and is associated with serious complications and also increased mortality at a much younger age.

CORONARY ARTERY DISEASE RISK FACTORS[27]:

Asian Indians have a different set of risk factors in comparison to westerners.

MODIFIABLE[27]:

Male age > 35 years

Female age > 45 years

Family h/o premature CAD

NON MODIFIABLE[27]:

Hypertension

Cigarette smoking

Tobacco abuse

Diabetes mellitus

Apple obesity or BMI>22

Homocysteine > 10 mmol/l

MODIFIABLE:

Total cholesterol > 150mg/dl

Triglycerides > 150md/dl

LDL > 100mg/dl

APO-a Lp > 100mg/dl

HDL cholesterol <40mg/dl males, <50 mg/dl females

Alternative lipid and lipoprotein measures[77]:

LDL's major apolipoprotein apoB is a better indicator than LDL cholesterol in clinical practice[77].

Non HDL cholesterol defined as T. cholesterol - HDL cholesterol correlates with ApoB levels[77].

TCL/HDL ratio is very strong risk predictor even superior to apoB/ApoA-I[77.]

Inspite of the importance of blood lipids, 50% of ACS occurs in those without hyperlipidemia

Although use of global prediction models has improved the detection of Heart disease risk, as many as 20% occur in the absence of classic vascular risk factors.

RISK FACTORS ND INTERVENTIONS FOR CORONARY ARTERY DISEASE[87]:

Class	**Risk factors[87]**	**Intervention[87]**
1	Smoking High BP Dysplipidemia	Cessation of smoking BP control Lipid management
2	Diabetes, prediabetes Sedentary lifestyle	Diabetes control Physical activity

	Obesity Diet,alcohol	Weight control Improved diet
3	Menopause Micronutrients Psychological factors Novel biomarkers	Hormone replacement therapy

BIOMARKERS OF INLAMMATION[77]:

hsCRP[77]

Homocysteine[77]

Lipoprotein(a)[77]

DEFINITION[90]:

Stable angina usually presents as deep, poorly localisable chest discomfort or arm discomfort, that can be reproducibly precipitated by an emotional stress or an exertion, and is relieved within a period of 5-15 minutes by rest or by sublingual NTG.

Unstable angina is angina with atleast one of the following three features:

1. Occurs at rest (or with minimal exertion) and lasts >20 minutes (if it is not interrupted by using nitrate or by an analgesic)
2. Usually severe and described as a frank pain of new onset (i . e., within a period of one month)

3. Occurs with crescendo pattern

When patients are having evidence of myocardial necrosis in the form of elevated serum biomarkers , a diagnosis of NSTEMI is made.

REVISED DEFINITION FOR MI[102]:

Either of the following criteria is necessary for diagnosing an acute, evolving or recent MI:

1. Typical rise and fall(troponin) or rapid rise and fall (CK-MB) of biochemical markers involved in necrosis with atleast one of the following[102]:

A) Ischemic symptoms

B) Development of pathologic Q waves on the ECG reading

C) ECG changes that are indicative of ischemia (ST segment elevation/depression)

D) Coronary artery intervention(eg: coronary angioplasty)

2. Pathologic findings of acute MI:

Criteria for established MI[102]:

Presence of one of the criterias indicate the presence of established MI :

A. Development of pathological new Q waves on serial ECG's.

B. Pathologic findings suggestive of a healing or healed MI.

PATHOPHYSIOLOGY[90]:

Important factors determining demand are heart rate, contractility, wall stress. Blood flow through coronary arteries takes place in aphasic pattern. 3 sets arteries are involved. Large epicardial arteries - R1, prearteriolar vessels-R2, arteriolar and intramyocardial vessels - R3. Coronary resistance is primarily determined by R2 and R3.

The cause of ischemia is because of reduction in flow due to atherosclerotic obstruction. The acute coronary syndromes are usually initiated by an abrupt conversion of a stable atherosclerotic plaque to an unstable lesion because of erosion, ulceration, fissuring, rupture or hemorrhage, usually with superimposed thrombus. This is termed as acute plaque change.

The spectrum of ACS contains unstable angina, NSTEMI, STEMI. They are because of evolution of plaque. It is in the form of activation of platelets and the coagulation cascade[94].

Inspite of various advances in lab diagnosis of ACS, what is of great importance is the history. A c/o chest pain can be elicited in 20-60% [76]of ACS patients. Other atypical presentations are[78]:

1. Atypical location of pain
2. CNS manifestations
3. Sudden psychosis/mania
4. Syncope

5. Acute indigestion
6. Overwhelming weakness.

To this list we can also add patients with “silent MI” - who are asymptomatic at onset. Diabetics and hypertensives more commonly have such atypical presentations[79].

PHYSICAL FINDINGS[30]:

In general, patients are restless, they attempt to relieve their discomfort by altering their position, rolling about in bed. Pallor that is associated with perspiration and cold extremities is a common presentation. Patients with anterior infarction usually have sympathetic overactivity and those with inferior infarction have signs of parasympathetic hyperactivity[74].

It is difficult to palpate the apical impulse. Gallop sounds (S3,S4)can be heard. S1 intensity may be reduced . S2 may be paradoxically split. Systolic murmurs can be heard in the mitral area.

KILLIP CLASSIFICATION[31]:

Class	Definition
I	Patients with MI with no evidence Suggestive of failure
II	Patients with MI, with early failure that is present as bibasilar rales (<1/2 of lung fields)+/-S3gallop
III	Presence of pulmonary edema(in >1/2 of the lungs)
IV	Cardiogenic shock

HEMODYNAMIC SUBSET IN ACUTE MI[88] :

Subsets[88]	Based on invasive monitoring[88]
I	PCWP<18, CI>2.2
II	PCWP>18, CI>2.2
III	PCWP<18, CI<2.2
IV	PCWP>18, CI <2.2

INVESTIGATIONS[32]:

1.ELECTROCARDIOGRAM:

A) **Repolarization abnormalities**: In transmural ischemia the ST vector is in the direction of epicardial layers[103] and hence tall positive T waves (hyper acute) and ST elevation are found over the ischemic zone. There is reciprocal ST depession in leads reflecting the opposite side of ischemic zone.

B) **QRS changes**: When sufficient myocardial tissue is necrosed it leads to reduced R wave amplitude or Q wave[103,104] in the leads reflecting the size of infarct.

An abnormal Q wave is sometimes associated with sub endocardial infarcts hence sometimes transmural infarcts occurs without Q waves.

C) **Evolution of ECG changes**:

Hyper acute T waves followed by ST elevation have seen to occur within hours followed by T inversion[103,104] and sometimes Q waves are found in the same lead distribution. T inversion resolves after some days or weeks or can persist indefinitely.

CARDIAC BIOMARKERS:

The ACC and AHA have recommended cTnI and cTnT as the firstline markers but an assay of CKMB can be accepted as an alternative. The preference of cardiac troponins over CKMB shows the importance of

troponin elevation when the CKMB levels is normal. If initial set of markers are negative in patients who have presented in the first 6 hours from the onset of chest pain it is recommended that another sample be drawn in the time period of 8-12 hours.

Cardiac specific Troponin (cTnT)[33,34,35,36] *and Cardiac Specific Troponin(cTnI)*[103,104] are having amino acid sequences that are different from the skeletal muscle forms of the same proteins. Using these differences quantitative assays have been developed with highly specific monoclonal antibodies. cTnT and cTnI are usually not detectable in normal individuals but thy may increase to more than 20 times the upper reference limit in patients with ST elevation MI. Hence their measurement is diagnostically useful and are the first line biomarkers. The cardiac troponins are very valuable when there is a suspicion of MI or skeletal muscle injury which may not be detected by CKMB , hence are of great importance in differentiating UA from end STEMI. Cardiac Troponin levels remain elevated for 7-10 days after the onset of STEMI.

Creatinine Phosphokinase : is elevated within 4-8 hours and returns to baseline by 48-72 hours[33]. The advantage of doing CKMB over total CK is the fact that MB isoenzyme of CK is usually not present in significant concentration in other extra cardiac tissue, hence is more specific. Cardiac surgery , electrical cardioversion and myocarditis have been shown to result in raised levels of MB isoenzyme. The relative

index of CKMB : CK activity =2.5 tells us it is a myocardial source than a skeletal source but is not diagnostic[103,104].

Most hospitals use cTnT or cTnI than CKMB as a routine marker for diagnosis of STEMI , however it is not cost effective to use both troponins and CKMB . The peak protein concentration usually does not correlate with infarct size. When recanalisation of a coronary artery occurs early , there is early peaking of biomarkers since there is a rapid washout from the infarct source interstitium that overwhelms the clearance of the proteins by the lymphatic system.

There is a polymorphonuclear leucocytosis[42] which is a nonspecific reaction to injury that appears within a few hours[103,104] from the onset of pain and will persist for 3-7 days , counts may reach levels of 12,000-15,000[103,104]. The ESR does not show a concurrent rise with the WBC count rather it rises slowly, peaks during first week and remains elevated for a week or two.

Lactate dehydrogenase (LDH) rises from baseline within 24-48 hours after the onset of myocardial infarction . It peaks by 3-6 days . It returns to baseline levels by 8-14 days.

Serum myoglobin[33,34,35] and serum heart type fatty acid binding protein (H-FABP)[83,103,104] are molecules that are small and hence can diffuse through interstitium faster than larger molecules like CK and

Troponin rapidly after cell death. They are not specific to myocardial tissue limiting their usefulness.

Ischemia modified albumin (IMA)[85,103,104] is approved by US FDA for clinical practice. IMA is detected by albumin cobalt binding test[103,104] that is based on the concept that the human albumin N terminus`s affinity for cobalt is decreased when patients have myocardial ischemia. The specificity of IMA is not parallel to that of troponins and hence limiting its usefulness.

B type natriuretic peptide (BNP) and NT- pro BNP arise when there is high ventricular wall stress. They are usually used for diagnosing heart failure. Their levels can be elevated in myocardial ischemia and their magnitude of elevation correlates with prognosis in ACS. But their rise in ACS is not specific hence limiting their usefulness.

Most patients with ACS without myocyte necrosis have increased levels of biomarkers like *CRP*[86]*, SAA,MPO*[84] *or IL-6.* Till day there is no specific study which has identifies exact decision cut points or has shown any benefit on admission on treatment strategy using these biomarkers. Hence their usefulness is uncertain.

LIPID PROFILE:

It should be obtained after a period of 24-48 hours[39,40,41] of acute MI because during the first 24 hours cholestrol levels remain at baseline and they fall after the time period.

IMAGING :

A) **CHEST X ray :**

In the chest X ray we can define the degree of congestion and size of the left side of the heart which maybe useful in defining the subsets of patients.

B) **2D echo cardiography:**

Presence of wall motion abnormalities and measurement of ejection fraction are useful in prognostication after MI. Echo detects potentially viable and stunned myocardium , residual ischemia and patients who are at risk of developing failure and other mechanical complications after MI.

C) **Doppler echocardiography:**

It is useful in assessing blood flow in the chambers and across valves . It detects severity of MR/TR. It can identify the site of acute ventricular septal rupture. It can quantify shunt flow across the defect. It can be used to assess acute cardiac tamponade.

COMPLICATIONS OF MYOCARDIAL INFARCTION :

1) Left ventricular failure
2) Cardiogenic shock
3) Mechanical complications: rupture of AV valve, interventricular septal rupture, papillary muscle dysfunction/ rupture, mitral regurgitation.
4) Arrythmias
5) VT/VF
6) AF/ TSVT
7) AV blocks/ junctional escape rhythms.
8) Dressler`s syndrome, left ventricular aneurysm.

MORTALITY :

The mortality rate in STEMI is around 4-10% in published trials[9]. However in CREATE registry[82] , mortality rate of 8.6% was recorded[82]. A study from Vellore reported 16.9% In-hospital mortality[12].

MORBIDITY:

STEMI has the highest number of complications due to transmural involvement. The large size of infarct tissue hypoperfusion at microvascular level are important factors in predicting morbidity[48,49].

HYPONATREMIA

Hyponatremia, which is defined as a plasma sodium concentration of less than 135 mmol per liter, is the most common electrolyte abnormality in hospitalized patients; it affects approximately 15 to 30% of children and adults who are hospitalized[13,91,].

PSEUDO HYPONATREMIA[89,51,52,53,54]:

Gross elevation in plasma lipids or proteins increase the plasma volume and can cause reduction in the measured plasma sodium concentration[89]. The hyponatremia in this situation does not present a decrease in extra cellular sodium relative to extra cellular water[89].

I. *Hyponatremia with normal plasma osmolality* is seen in

1. Hyperlipidemia
2. Hyperproteinaemia
3. Post TURP

II. *Increased plasma osmolality*

1. Hyperglycemia
2. Mannitol

Hyponatremia is sub divided as:

1.Hypovolemic

2.Euvolemic

3.Hypervolemic

HYPOVOLEMIC HYPONATREMIA[89]:

It can be divided as

1. Urinary sodium > 20mmol/l -renal loss

2. Urinary sodium<20mmol/l-extra renal loss

Renal loss: Causes:

1.Diuretic excess

2.Salt losing nephropathy

3.Mineralo-corticoid deficiency

4.Osmotic diuresis

5.Cerebral salt wasting

6.Bicarbonate urea with Renal tubular acidosis and metabolic alkalosis

Extra renal loss: Causes:

1. Vomiting

2. Diarrohea

EUVOLEMIC HYPONATREMIA[89]:

Euvolemic hyonatremia is associated with increased total body water but total body sodium is normal and no edema .

Causes:

1. Gluco corticoid deficiency
2. Hypothroidism
3. Psychosis
4. Post operative hyponatremia
5. Exercise induced hyponatremia
6. Drugs- Thiazide diuretics, Selective Seratonin Reuptake Inhibitors (SSRI`s), Desmopressin, IV Ig.
7. Syndrome of inappropriate ADH secretion (SIADH)

HYPERVOLEMIC HYPONATREMIA [89]:

Urinary sodium < 20mmol/l occurs in,

1. CHF
2. Liver cirrhosis
3. NS

Urinary sodium > 20mmol/l ,

1. AKI or CRF.

CLINICAL FEATURES

Most patients with serum sodium concentration > 125mmol/l are asymptomatic[89].

When sodium concentration is < 125 mmol/l there is[89],

1. Headache

2. Yawning
3. Lethargy
4. Nausea
5. Reversible ataxia
6. Psychosis
7. Seizures
8. Coma

NEURO HORMONAL MECHANISM FOR HYPONATREMIA FOLLOWING ACUTE CORONARY SYNDROMES[55]:

In an acute myocardial infarction AVP is released in a non osmotic fashion due to left ventricular dyfunction which ensues , in response to pain[56] , stress or in response to diuretic[57] administration.

In this setting AVP levels are found to increase along with renin and nor epinephrine[58] . However levels of AVP do not correlate with the serum osmolarity which suggest that non osmotic mechanisms are involved[59].

As in congestive cardiac failure activation of carotid and aortic baroreceptors due to arterial underfilling[59] has been implicated as one of the reasons for non osmotic release of AVP. Moreover the renal effect of AVP is enhanced primarily in the collecting duct[60].

In myocardial infarction renin-angiotensin axis and catecholamines decrease the Glomerular filtration rate[61,62] contributing to decreased renal water excretion and hyponatremia [61,62].

Flear CT, Hilton P[22] in their study in patients who were admitted in a coronary care unit, concluded that the presence of hyponaetremia, hypochloraemia, and also uraemia were common in patients who were confirmed to have myocardial infarction. The degree of the infarct correlated with all the above indices. In hospital mortality rates of patients with hyponaetremia was higher in their study[22].

Szatalowicz et al[63] have shown that the presence of AVP is essential for development of hyponatremia and also that AVP levels were detectable in 30 of 37 patients with CHF[63].

Siggurdson, Swedberg[20] in their study conducted on 55 patients with acute MI have concluded that the sustained neurohormonal activation that follows MI usually occurs in patients in whom there is clinical heart failure and is also related to the magnitude of the myocardium that is damaged , even in patients without heart failure[20].

Goldberg et al[64] in their study of 978 patients have concluded that the presence of early hyponatremia is a simple marker of the neurohormonal activation that occurs during acute phase of MI and is a predictor of the long-term development of failure and death[64].

Rouleau JL et al[65] in their study of 534 patients have concluded that the presence of neurohormonal activation even at the time of discharge from the hospital in post infarction patient is by itself a sign of poor prognosis[65].

Bogdan[93] et al reported that a high prevalence of hyponatremia was seen within first 72 hours of transmural MI[93.]

Kloptowski et al[93]reported that the patients with acute MI usually developed hyponatremia on admission or within 48 hours of admission.

MATERIALS AND METHODS

MATERIALS AND METHODS:

75 patients were admitted to ICU of GOVERNMENT ROYAPETTAH HOSPITAL between April 2016 to September 2016 with Acute Coronary Syndromes (ACS) were studied.

STUDY DESIGN:

1) Single centered
2) Prospective
3) Follow up study

STEMI was diagnosed by :

DIAGNOSIS OF STEMI:

1.Chest pain more than 20 minutes duration

2.ST segment elevation > 1mm in 2 standard limb leads (or) >2mm in 2 contiguous precordial leads (or) new onset LBBB (and/or) elevated serum cardiac biomarkers.

STUDY PARTICIPANTS

A)**Inclusion criteria**: Patients presented within 12 hours of symptoms with ECG evidence of STEMI , end STEMI or UA were included in our study.

B)**Exclusion criteria**:

1.people with previous history of CAD

2.People with previous history of Arrythmias

3.People with previous history of cardiomyopathy or heart failure

4.People with previous diuretic use

5.People with Cirrhosis of liver, Hypothyroidism, Renal disease.

6.Patients with creatinine >2mg/dl, urea>60mg/dl.

7.Patients who were not willing to participate were voluntarily excluded.

METHODS:

12 lead ECG for all patients was taken. Leads V3R, V4R, V7, V8,V9 were taken if the patient had inferior wall MI.

Definition of the location of infarct:

Antro septal MI: When ST elevation is seen in V1-V4.

Antro lateral MI: When ST elevation is seen in L1, avL, V4-V6

Extensive anterior wall MI: When ST elevation is seen in I,aVL,V1-V6

Inferior wall MI: When ST elevation is seen in LII,III,aVF

Right ventricular wall MI: When ST elevation is seen V3R,V4R

Posterior wall MI: when there is tall and wide R wave, depressed and concave upwards ST, widened and upright T wave in V2.

The data of baseline characters of the participating patients like age, gender ,risk factors were recorded. Pulse, Blood pressure, JVP of the patient were recorded. Cardiovascular respiratory system findings were recorded. Lab investigations - blood sugar, renal function test and electrolytes were done for all participating patients at admission. Lipid profile and chest Xray were done for the participating patients before discharge. Plasma sodium concentration of the

participating patients were obtained during admission at 48 hours and at discharge.

All patients were treated in accordance to AHA/ACC guidelines as required. Hemodynamic status of the patients were monitored at regular intervals clinically. EF regional wall motion abnormalities were analysed with Echocardiogram. After discharge the participating patients were followed up weekly for 30 days . Morbidity data and mortality data were recorded.

STUDY END POINTS:

The primary end point of the study was mortality within 30 days of acute coronary syndrome .

MEASUREMENT OF SERUM SODIUM:

Plasma sodium concentration was measured by using an ISE (Ion Selective Electrode) . Hyponatremia was considered as sodium < 135mmol/l.

STUDY PROTOCOL:

Approval for this study has been obtained from the ethical committee of KILPAUK MEDICAL COLLEGE, KILPAUK. Consent from all the participating patients were obtained. Data of each patient were collected on a proforma , that was specifically designed for

the study and included demographic details , clinical features, medical history , investigations and examination.

RESULTS

Groups

Groups	Definition of Subjects	Number
Hyponatremia	**Blood Sodium <135 mEq/L**	9
Normonatremia	**Blood Sodium ≥136 mEq/L**	66

Null Hypothesis

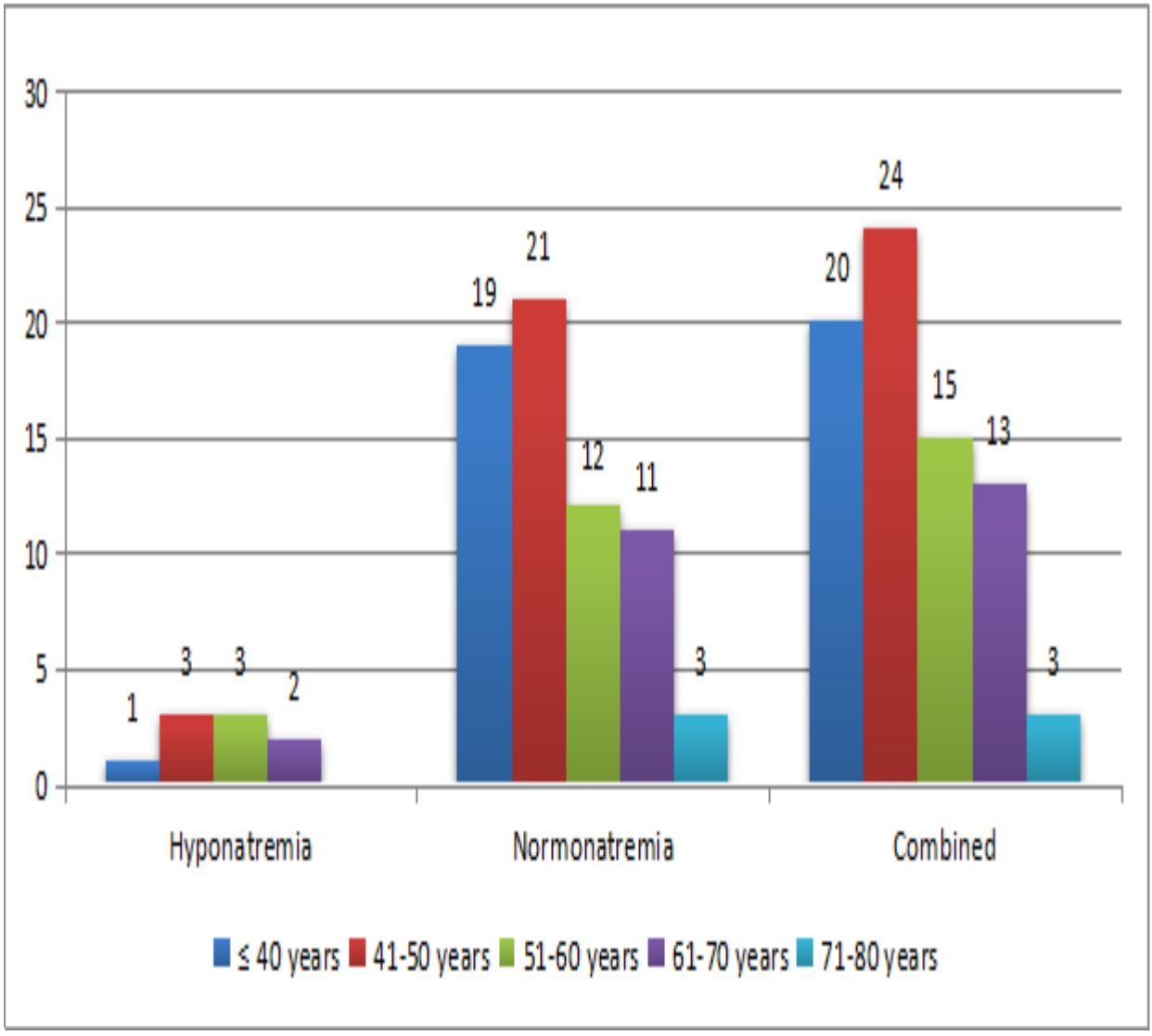
Null Hypothesis : H0	Hyponatremia group equal in effect compared to Normonatremia group
Alternate Hypothesis : H1	Hyponatremia group hazardous in effect compared to Normonatremia group

Data Analysis

Descriptive statistics was done for all data and were reported in terms of mean values and percentages. Suitable statistical tests of comparison were done.

Continuous variables were analysed with the unpaired t test.. Categorical variables were analysed with the Chi-Square Test and Fisher Exact Test. Statistical significance was taken as $P < 0.05$. The data was analysed using SPSS version 16 and Microsoft Excel 2007.

Age

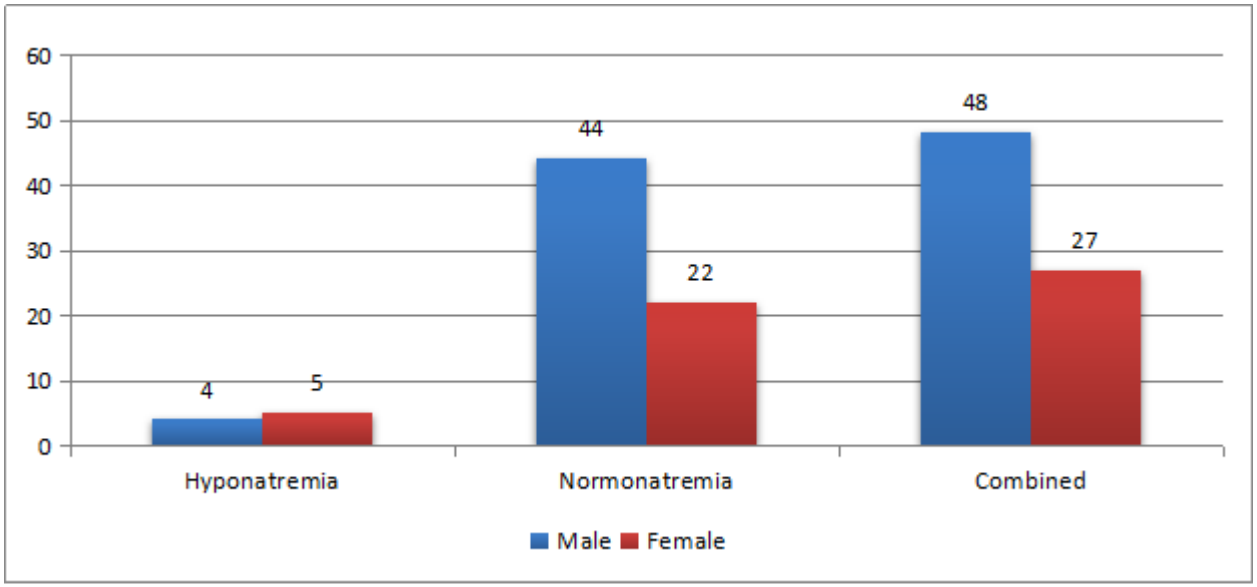

30
25
20
15
10
5
0
1
3
3
2
19
21
12
11
3
20
24
15
13
3
Hyponatremia
Normonatremia
Combined
≤ 40 years
41-50 years
51-60 years
61-70 years
71-80 years

Age	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
≤ 40 years	1	19	20	11.11	28.79	26.67
41-50 years	3	21	24	33.33	31.82	32.00
51-60 years	3	12	15	33.33	18.18	20.00
61-70 years	2	11	13	22.22	16.67	17.33
71-80 years	0	3	3	0.00	4.55	4.00
Total	9	66	75	100	100	100

Age Distribution	**Hyponatremia**	**Normonatremia**	**Combined**
Mean	54.44	48.95	49.61
SD	10.04	11.76	11.64
P value Unpaired t Test		0.1863	

Among the study patients, there was no statistically significant difference in relation to age distribution between Hyponatremia group (mean=54.44, SD=10.04) and Normonatremia group (mean=48.95, SD=11.76) with a p value of <0.05 as per unpaired t test. Therefore we fail to reject the null hypothesis that there is no difference in age distribution between the study groups. The mean age in our study is 49.61+/- 11.61, while in Goldberg et al it was 61+/-12. Hence Indians are prone to get MI at an younger age.

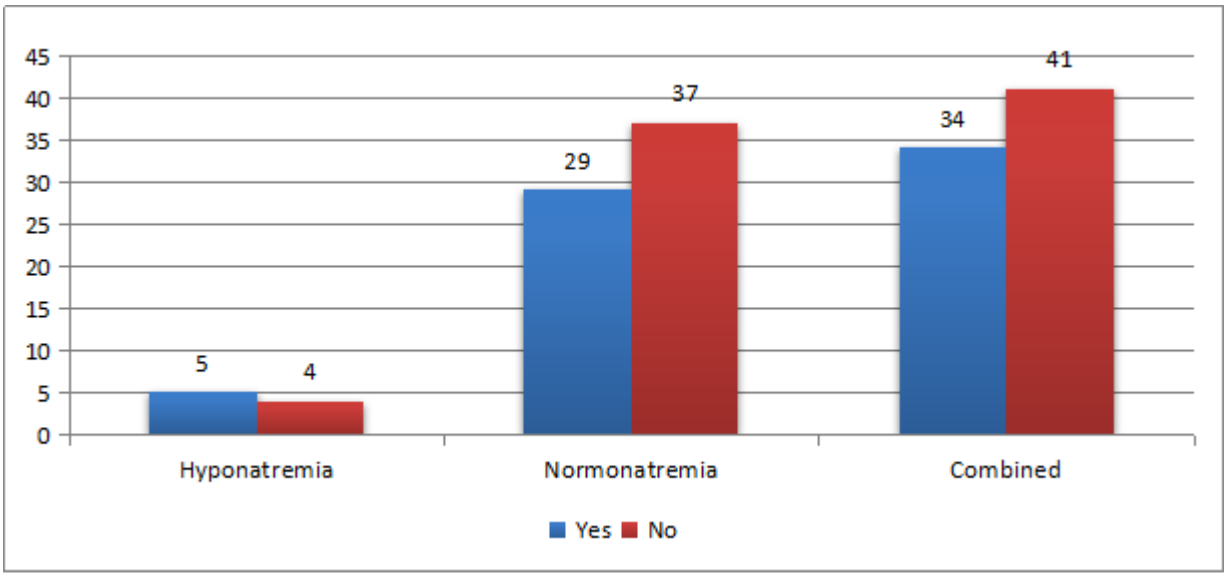
Gender



Gender	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Male	4	44	48	44.44	66.67	64.00
Female	5	22	27	55.56	33.33	36.00
Total	9	66	75	100	100	100
P value Fishers Exact test			0.1926			

Among the study patients, there was no statistically significant difference in relation to gender status between Hyponatremia group (majority are females – 55.56%) and Normonatremia group (majority are males – 66.67%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in gender status between the study groups.

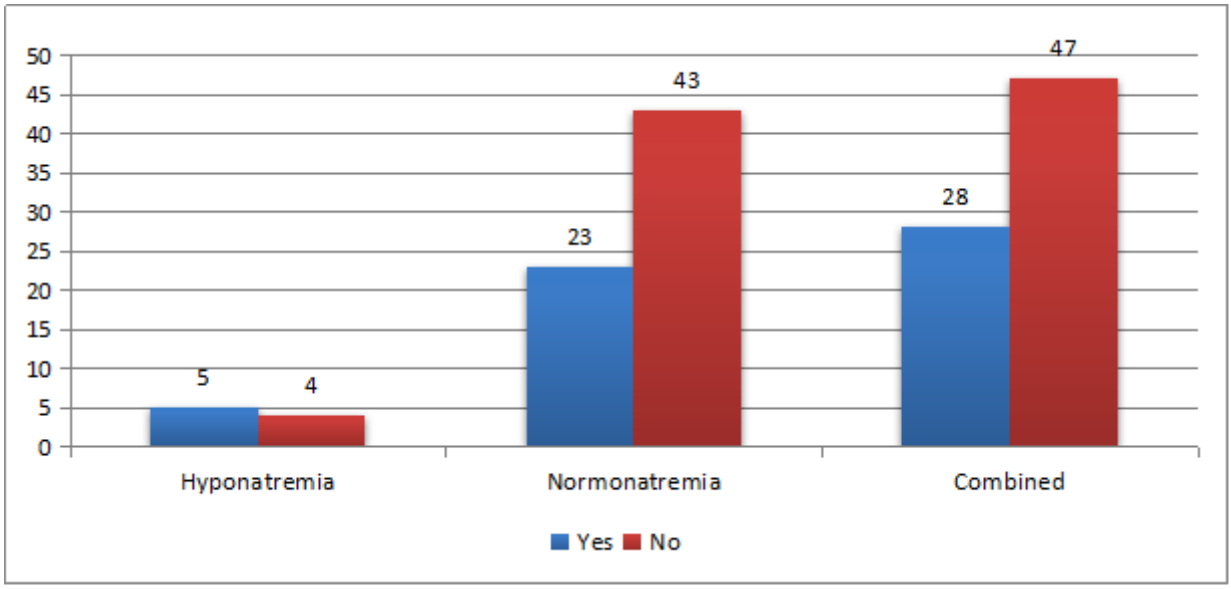
Diabetes Mellitus



Diabetes Mellitus	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Yes	5	29	34	55.56	43.94	45.33
No	4	37	41	44.44	56.06	54.67
Total	9	66	75	100	100	100
P value Fishers Exact test			0.5114			

Among the study patients, there was no statistically significant difference in relation to diabetes mellitus status between Hyponatremia group (majority are diabetics – 55.56%) and Normonatremia group (majority are non diabetics – 56.06%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in diabetes mellitus status between the study groups.

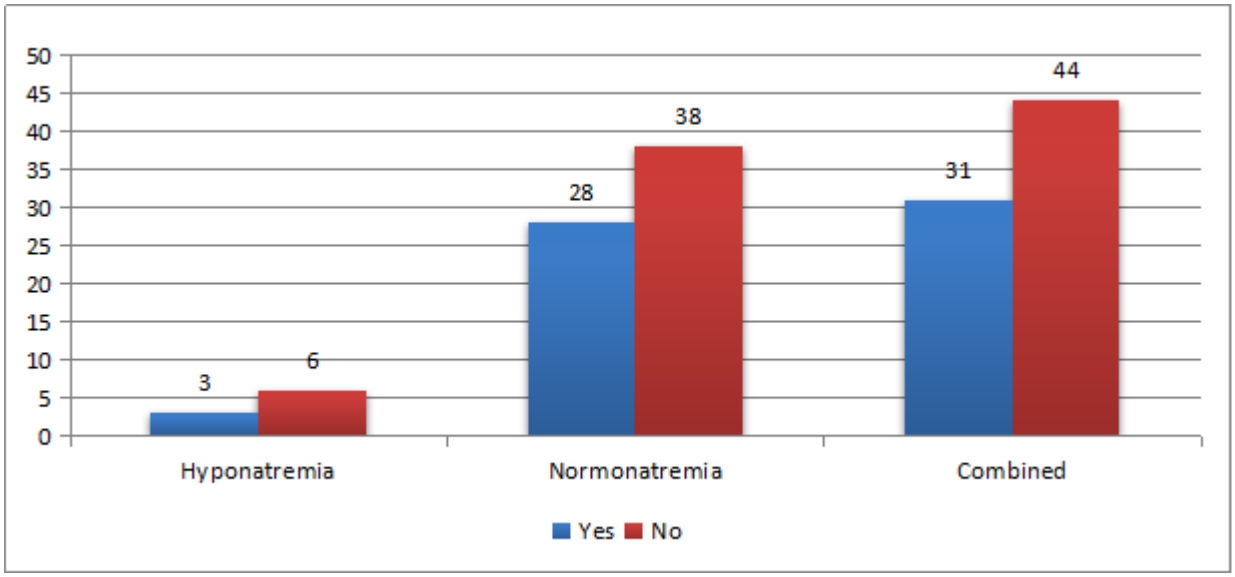
Hypertension



Hypertension	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Yes	5	23	28	55.56	34.85	37.33
No	4	43	47	44.44	65.15	62.67
Total	9	66	75	100	100	100
P value **Fishers Exact test**			0.2283			

Among the study patients, there was no statistically significant difference in relation to hypertension status between Hyponatremia group (majority are hypertensives – 55.56%) and Normonatremia group (majority are normotensives – 65.15%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in hypertension status between the study groups.

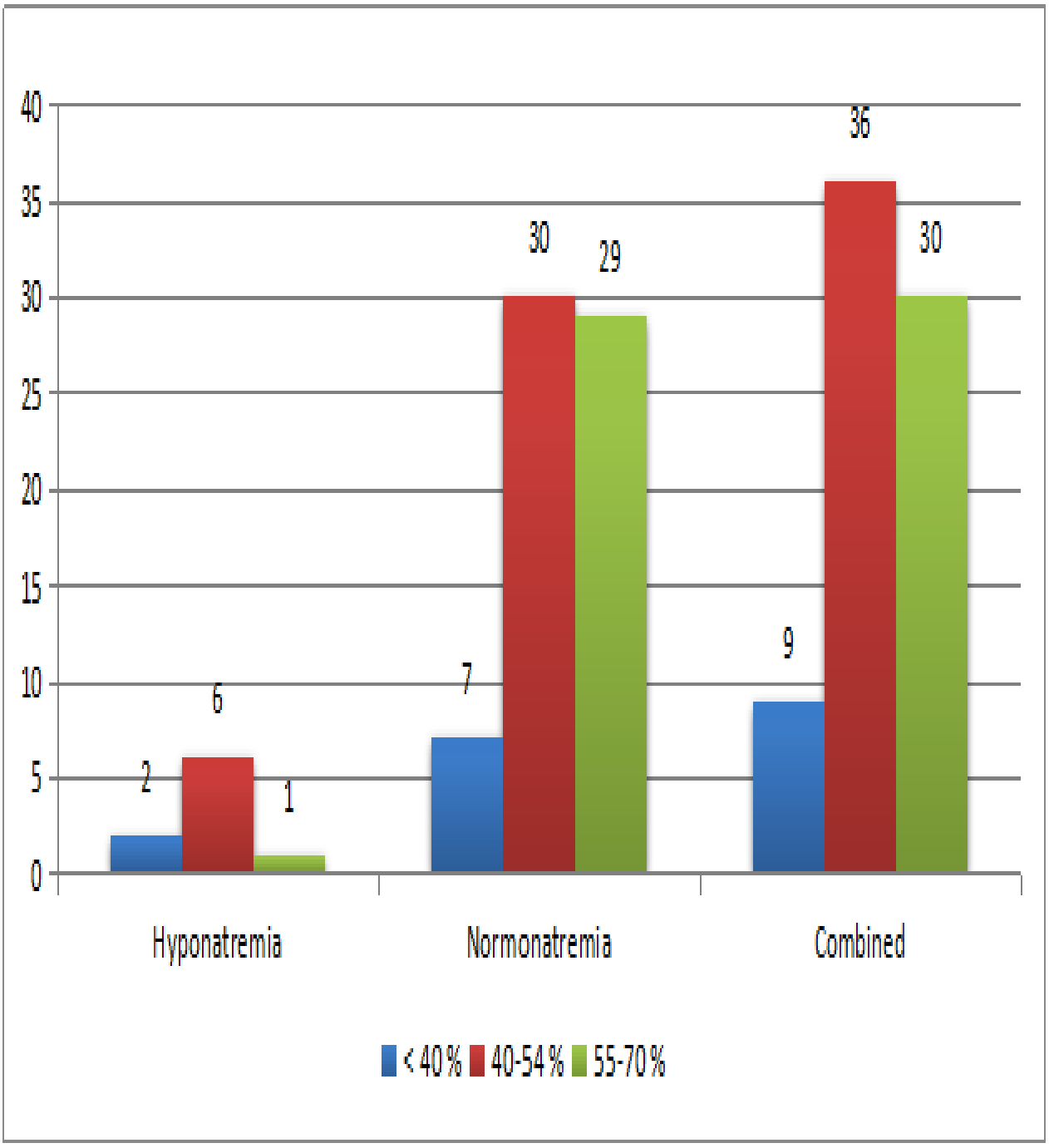
Smoking



Smoking	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Yes	3	28	31	33.33	42.42	41.33
No	6	38	44	66.67	57.58	58.67
Total	9	66	75	100	100	100
P value **Fishers Exact test**			0.6034			

Among the study patients, there was no statistically significant difference in relation to smoking status between Hyponatremia group (majority are non smokers – 66.67%) and Normonatremia group (majority are non smokers – 57.58%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in smoking status between the study groups.

Ejection Fraction



Ejection Fraction	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
< 40 %	2	7	9	22.22	10.61	12.00
40-54 %	6	30	36	66.67	45.45	48.00
55-70 %	1	29	30	11.11	43.94	40.00
Total	9	66	75	100	100	100

Ejection Fraction Distribution	Hyponatremia	Normonatremia	Combined
Mean	46.67	53.77	52.92
SD	7.70	9.96	9.95
P value Unpaired t Test		0.0436	

Among the study patients, there was a statistically significant difference in relation to ejection fraction distribution between Hyponatremia group (mean=46.67, SD=7.70) and Normonatremia group (mean=53.77, SD=9.96) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in ejection fraction distribution between the study groups.

Discussion

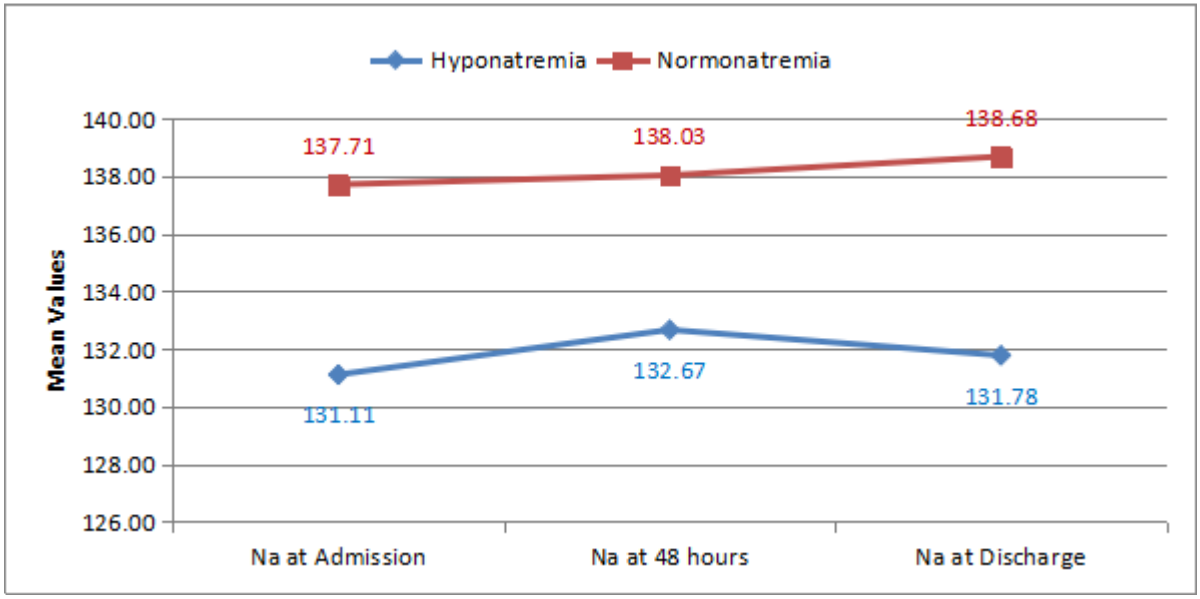
The mean ejection fraction was significantly less in Hyponatremia group compared to Normonatremia group by a mean difference of 7.11% (13% lower). This difference is significant with a p-value of 0.0436 as per unpaired t test.

Conclusion

In this study we can safely conclude that a significantly decreased ejection fraction is associated with Hyponatremia compared to increased ejection fraction found in Normonatremia in patients with acute coronary syndrome

In other words lowered ejection fraction measurements were 1.15 times more common in Hyponatremia compared Normonatremia in patients with acute coronary syndrome.

Blood Sodium Levels



Blood Sodium Levels		Na at Admission	Na at 48 hours	Na at Discharge
Hyponatremia	Mean	131.11	132.67	131.78
	SD	2.80	2.87	3.56
Normonatremia	Mean	137.71	138.03	138.68
	SD	1.48	2.64	2.68
P value Unpaired t Test		<0.0001	<0.0001	<0.0001

Na at Admission

Among the study patients, there was a statistically significant difference in relation to Na at Admission distribution between Hyponatremia group (mean=131.11, SD=2.80) and Normonatremia group (mean=137.71, SD=1.48) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in Na at Admission distribution between the study groups.

Discussion

The mean Na at Admission was significantly less in Hyponatremia group compared to Normonatremia group by a mean difference of 6.60 mg/dl (5% lower). This difference is significant with a p-value of <0.0001 as per unpaired t test.

Conclusion

In this study we can safely conclude that a significantly decreased Na at Admission is associated with Hyponatremia compared to increased Na at Admission found in Normonatremia in patients with acute coronary syndrome

Na at 48 Hours

Among the study patients, there was a statistically significant difference in relation to Na at 48 hours distribution between Hyponatremia group (mean=132.67, SD=2.87) and Normonatremia group (mean=138.03, SD=2.64) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in Na at 48 hours distribution between the study groups.

Discussion

The mean Na at 48 hours was significantly less in Hyponatremia group compared to Normonatremia group by a mean difference of 5.36 mg/dl (4% lower). This difference is significant with a p-value of <0.0001 as per unpaired t test.

Conclusion

In this study we can safely conclude that a significantly decreased Na at 48 hours is associated with Hyponatremia compared to increased Na at 48 hours found in Normonatremia in patients with acute coronary syndrome

Na at discharge

Among the study patients, there was a statistically significant difference in relation to Na at discharge distribution between Hyponatremia group (mean=131.78, SD=3.56) and Normonatremia group (mean=138.68, SD=2.68) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in Na at discharge distribution between the study groups.

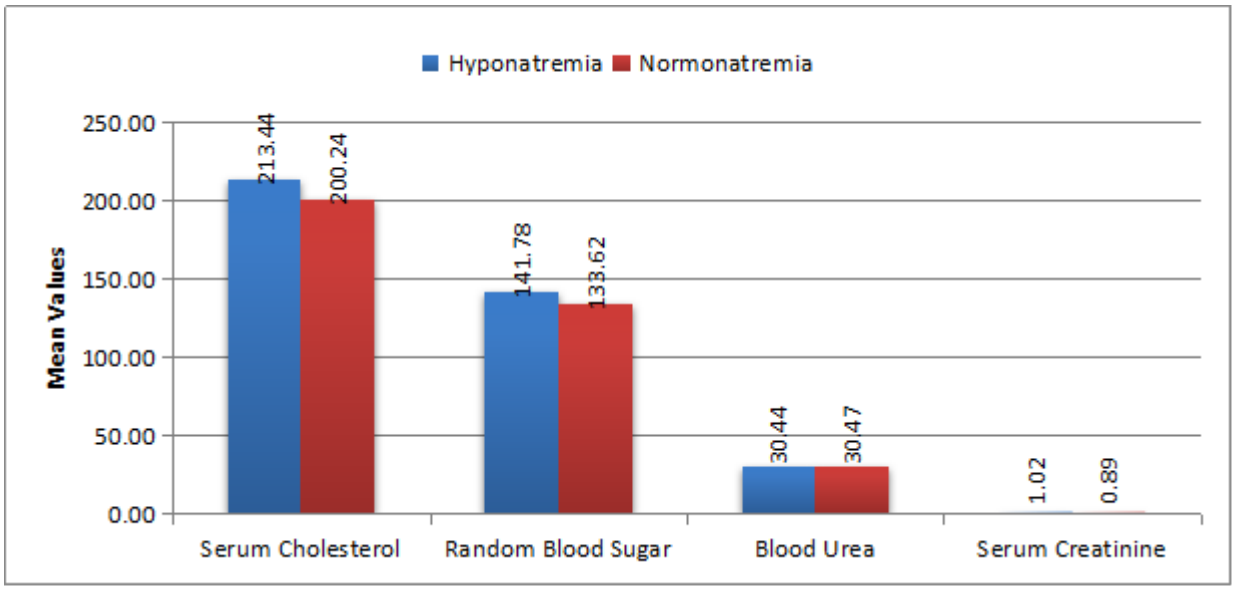
Discussion

The mean Na at discharge was significantly less in Hyponatremia group compared to Normonatremia group by a mean difference of 6.90 mg/dl (5% lower). This difference is significant with a p-value of <0.0001 as per unpaired t test.

Conclusion

In this study we can safely conclude that a significantly decreased Na at discharge is associated with Hyponatremia compared to increased Na at discharge found in Normonatremia in patients with acute coronary syndrome

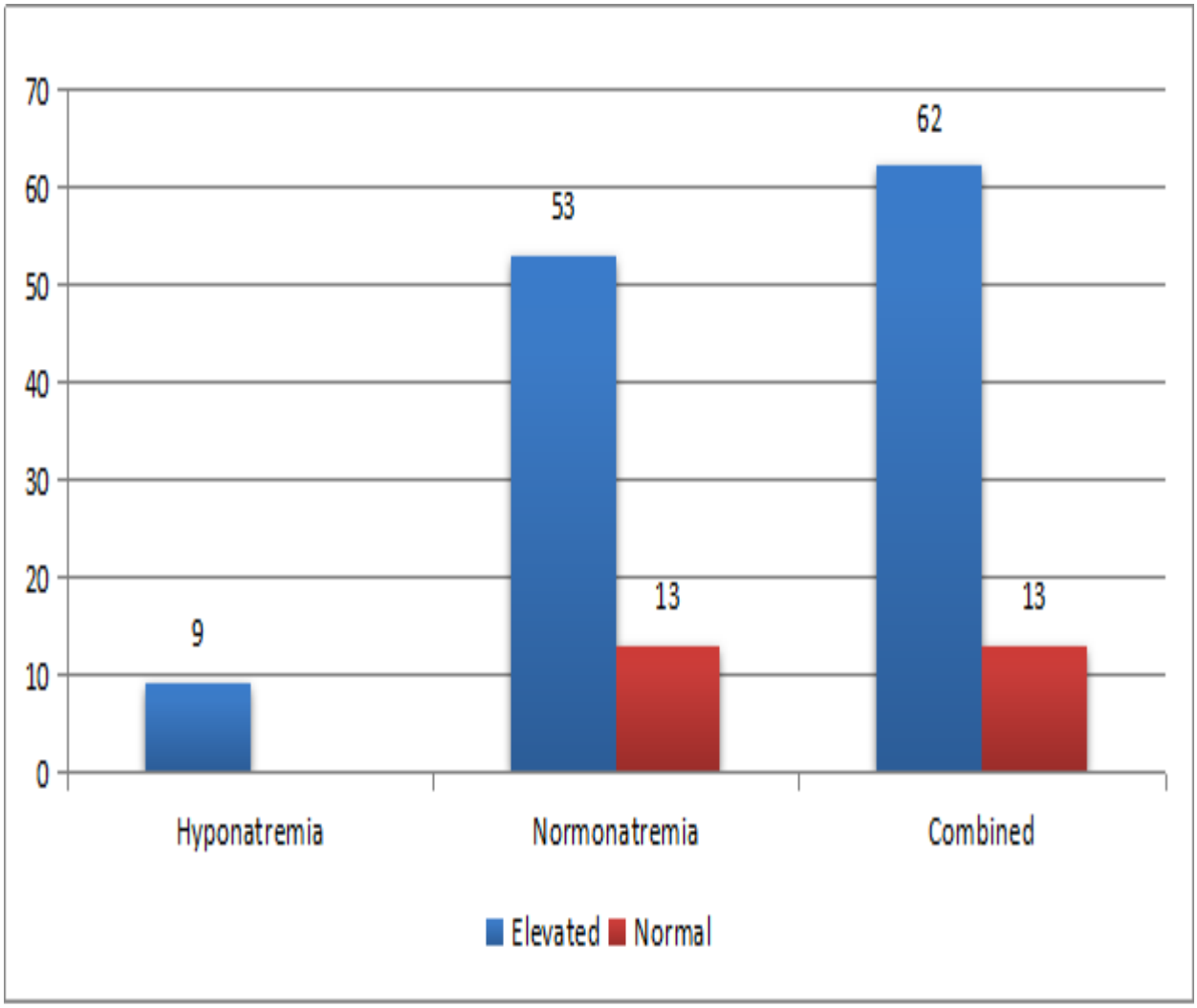
Laboratory Parameters



Laboratory Parameters		Serum Cholesterol	Random Blood Sugar	Blood Urea	Serum Creatinine
Hyponatremia	Mean	213.44	141.78	30.44	1.02
	SD	33.20	33.79	4.85	0.20
Normonatremia	Mean	200.24	133.62	30.47	0.89
	SD	27.88	44.66	4.55	0.17
P value Unpaired t Test		0.1966	0.6001	0.9877	0.0660

Among the study patients, there was no statistically significant difference in relation to serum cholesterol, random blood sugar, blood urea and serum creatinine distribution between Hyponatremia group and Normonatremia group with a p value of <0.05 as per unpaired t test. Therefore we fail to reject the null hypothesis that there is no difference in serum cholesterol, random blood sugar, blood urea and serum creatinine distribution between the study groups.

Troponin T


70
60
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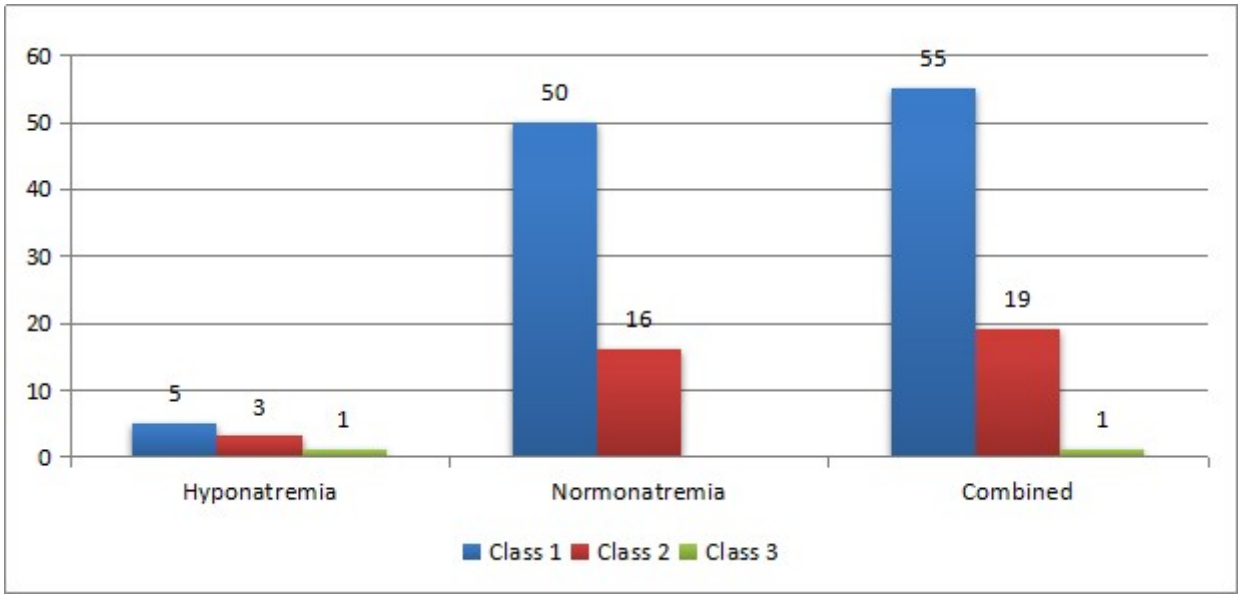
20
10
0
9
53
13
62
13
Hyponatremia
Normonatremia
Combined
Elevated
Normal

Troponin T	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Elevated	9	53	62	100.00	80.30	82.67
Normal	0	13	13	0.00	19.70	17.33
Total	9	66	75	100	100	100
P value Fishers Exact test			0.1431			

Among the study patients, there was no statistically significant difference in relation to troponin T status between Hyponatremia group (majority had elevated troponin T– 100%) and Normonatremia group (majority had elevated troponin T – 80.30%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in troponin T status between the study groups.

Killip Classification



Killip Classification	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Class 1	5	50	55	55.56	75.76	73.33
Class 2	3	16	19	33.33	24.24	25.33
Class 3	1	0	1	11.11	0.00	1.33
Total	9	66	75	100	100	100
P value **Fishers Exact test**			0.0461			

Among the study patients, there was a statistically significant difference in relation to Killip classification status between Hyponatremia group (majority had class 1 – 55.56%) and Normonatremia group (majority had class 1 – 75.76%) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in Killip classification status between the study groups.

Discussion

The Killip classification class -1 incidence was significantly less in Hyponatremia group compared to Normonatremia group by a percentage difference of 20.20 points (27% lower).

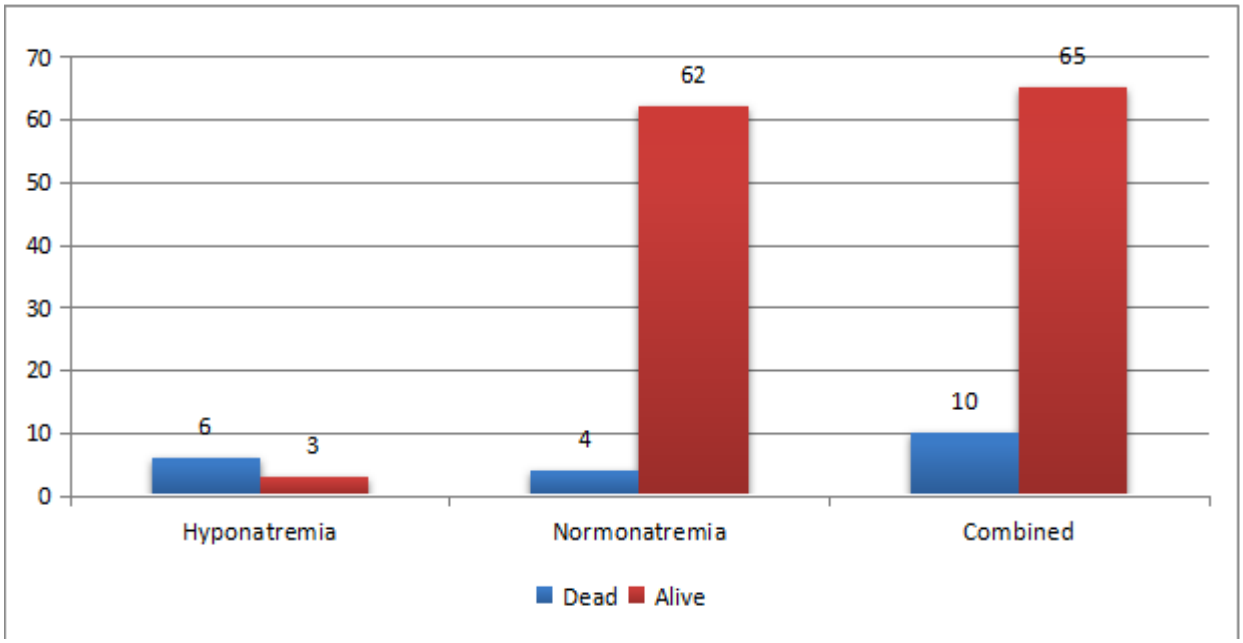
The Killip classification class -2&3 incidence was significantly more in Hyponatremia group compared to Normonatremia group by a percentage difference of 20.20 points (45% higher). This difference is significant with a p-value of 0.0461 as per unpaired t test.

Conclusion

In this study we can safely conclude that a significantly elevated Killip classification is associated with Hyponatremia compared to decreased killip classification found in Normonatremia in patients with acute coronary syndrome

In other words elevated Killip classification (class 2&3) were 1.83 times more common in Hyponatremia compared Normonatremia in patients with acute coronary syndrome.

Follow - Up Outcome Status



Follow - Up Outcome Status	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Dead	6	4	10	66.67	6.06	13.33
Alive	3	62	65	33.33	93.94	86.67
Total	9	66	75	100	100	100
P value Fishers Exact test			<0.0001			

Among the study patients, there was a statistically significant difference in relation to follow up outcome status between Hyponatremia group (majority were dead– 66.67%) and Normonatremia group (majority were alive – 93.94%) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in follow up outcome status between the study groups.

Discussion

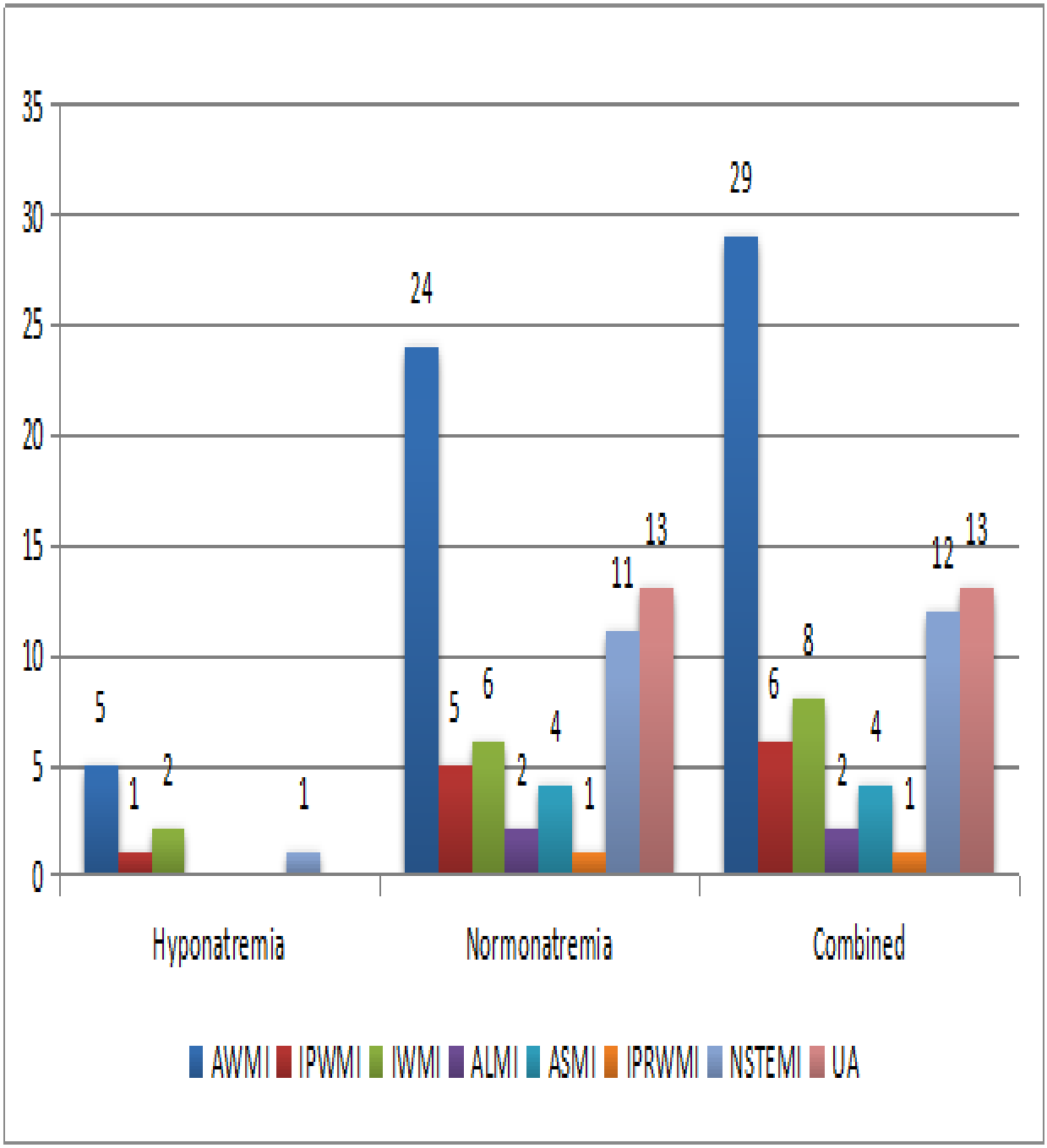
The incidence of death was significantly more in Hyponatremia group compared to Normonatremia group by a percentage difference of 60.61 % (91% higher). This difference is significant with a p-value of <0.0001 as per fishers exact test.

Conclusion

In this study we can safely conclude that a significantly elevated incidence of death is associated with Hyponatremia compared to decreased incidence of death found in Normonatremia in patients with acute coronary syndrome

In other words elevated incidence of death was 11 times more common in Hyponatremia compared to Normonatremia in patients with acute coronary syndrome.

Diagnosis


35
30
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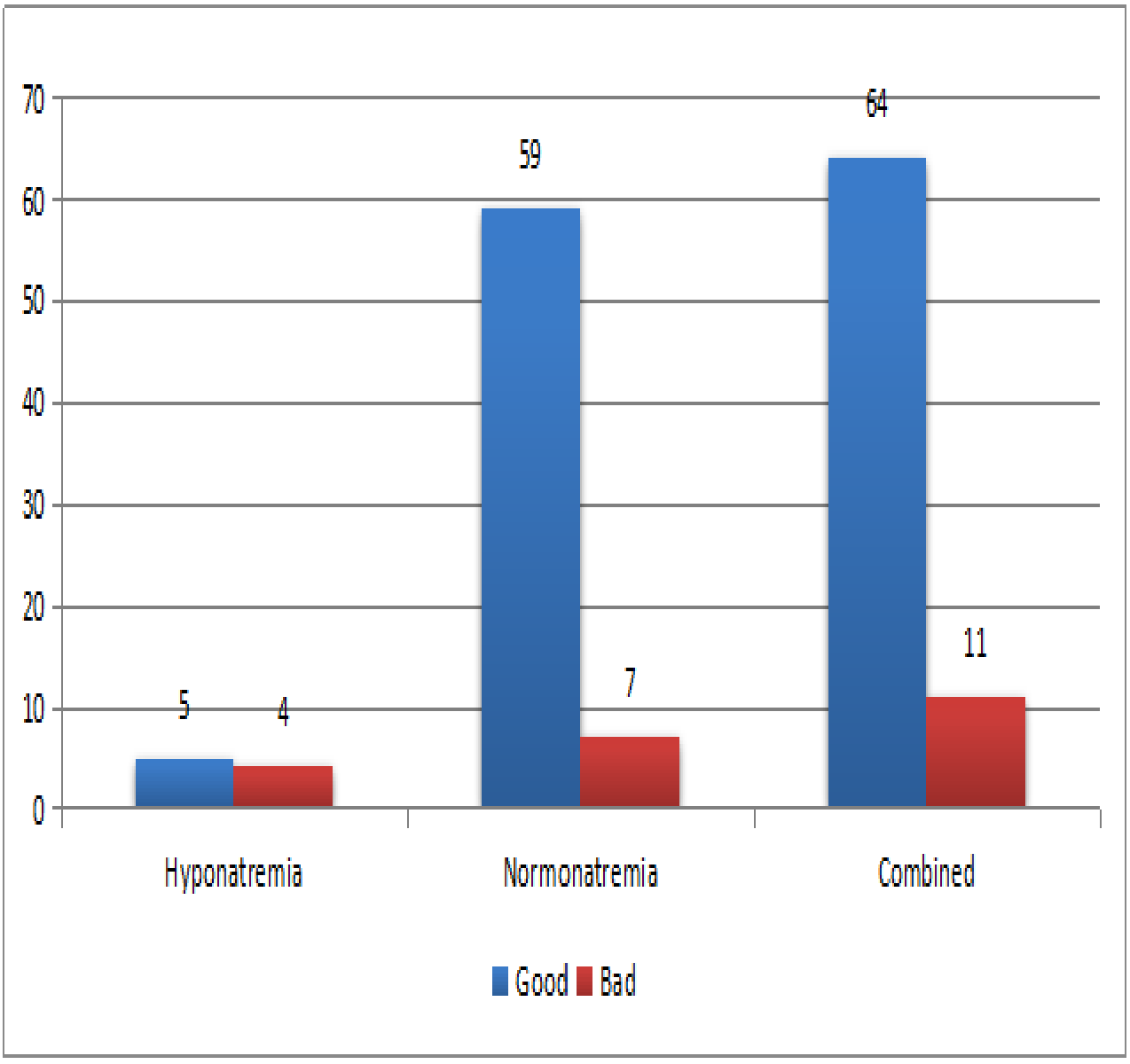
20
15
10
5
0
5
1
2
1
24
5
6
2
4
1
11
13
29
6
8
2
4
1
12
13
Hyponatremia
Normonatremia
Combined
AWMI
IPWMI
IWMI
ALMI
ASMI
IPRWMI
NSTEMI
UA

Diagnosis	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%	P value Fishers Exact Test
AWMI	5	24	29	55.56	36.36	38.67	0.2952
IPWMI	1	5	6	11.11	7.58	8.00	0.5488
IWMI	2	6	8	22.22	9.09	10.67	0.2441
ALMI	0	2	2	0.00	3.03	2.67	>0.9999
ASMI	0	4	4	0.00	6.06	5.33	>0.9999
IPRWMI	0	1	1	0.00	1.52	1.33	>0.9999
NSTEMI	1	11	12	11.11	16.67	16.00	>0.9999
UA	0	13	13	0.00	19.70	17.33	0.3457
Total	9	66	75	100	100	100	

Among the study patients, there was no statistically significant difference in relation to diagnosis status between Hyponatremia group (majority had AWMI – 55.56%) and Normonatremia group (majority had AWMI – 36.36%) with a p value of <0.05 as per fishers exact test. Therefore we fail to reject the null hypothesis that there is no difference in diagnosis status between the study groups.

In Hospital Outcome



In Hospital Outcome	Hyponatremia	Normonatremia	Combined	Hyponatremia %	Normonatremia %	Combined%
Good	5	59	64	55.56	89.39	85.33
Bad	4	7	11	44.44	10.61	14.67
Total	9	66	75	100	100	100
P value Fishers Exact test			0.0071			

Among the study patients, there was a statistically significant difference in relation to in-hospital outcome status between Hyponatremia group (majority had good outcome– 55.56%) and Normonatremia group (majority had good outcome – 89.39%) with a p value of <0.05 as per unpaired t test. Therefore we reject the null hypothesis that there is no difference in in-hospital outcome status between the study groups.

Discussion

The incidence of bad in-hospital outcome status was significantly more in Hyponatremia group compared to Normonatremia group by a

percentage difference of 33.84 % (76% higher). This difference is significant with a p-value of 0.0071 as per fishers exact test.

Conclusion

In this study we can safely conclude that a significantly elevated incidence of bad in-hospital outcome is associated with Hyponatremia compared to decreased incidence of bad in-hospital outcome found in Normonatremia in patients with acute coronary syndrome

In other words elevated incidence of bad in-hospital outcome was 4.19 times more common in Hyponatremia compared to Normonatremia in patients with acute coronary syndrome.

Logistic Regression Analysis

Logistic regression model for statistically Significant Independent Predictors of Risk of Death

Predictor Variable	Odds Ratio	Confidence Interval	P value
Age ≥ 65 Years	3.04	1.33-6.95	0.0082
Gender-Male	1.60	0.38–6.79	0.0896
Diabetic	2.04	0.37-11.41	0.4162
Hypertensive	4.13	0.45-37.57	0.2087
Smoker	2.97	0.91-9.66	0.0710
EF < 40 %	3.62	1.99-6.58	0.0001
Hyponatremia at Admission	10.18	1.09-94.73	0.0421
Hyponatremia at 48 hours	3.04	1.33-6.95	0.0182
Hyponatremia at discharge	4.29	1.12-16.52	0.0397
Elevated Troponin T	3.58	1.15-11.13	0.0433
Cholesterol > 150 mg/dl	1.25	0.96-2.64	0.3605
Blood Urea >	1.22	0.35-4.20	1.0000
Killip Classification ≥ 2	4.81	2.63-8.77	0.0001

Multivariate analysis demonstrated that

- The risk of death is 3.04 times significantly more in patients suffering from acute coronary syndrome with age ≥ 65 Years. It is statistically significant with a p-value of 0.0082
- The risk of death is 3.62 times significantly more in patients suffering from acute coronary syndrome with EF < 40%. It is statistically significant with a p-value of 0.0001
- The risk of death is 3.62 times significantly more in patients suffering from acute coronary syndrome with hyponatremia at admission. It is statistically significant with a p-value of 0.0421
- The risk of death is 3.04 times significantly more in patients suffering from acute coronary syndrome with hyponatremia at 48 hours. It is statistically significant with a p-value of 0.0182
- The risk of death is 4.29 times significantly more in patients suffering from acute coronary syndrome with hyponatremia at discharge. It is statistically significant with a p-value of 0.0182
- The risk of death is 3.58 times significantly more patients suffering from acute coronary syndrome with elevated troponin T. It is statistically significant with a p-value of 0.0433

- The risk of death is 4.81 times significantly more in patients suffering from acute coronary syndrome with Killip classification ≥ 2. It is statistically significant with a p-value of 0.0001

CONCLUSION

Conclusion:

Asians are more prone to develop ACS at a younger age when compared to Western population

Age ≥ 65 Years, EF < 40%, hyponatremia at admission, hyponatremia at 48 hours, hyponatremia at discharge, elevated troponin T and Killip classification ≥ 2 are significant and strong independent risk factors for predicting death in patients diagnosed acute coronary syndrome.

In other words patients diagnosed of acute coronary syndrome have 3-5 times more chances of death if one of the above independent predictor variable also occurs.

Hence hyponatremia on admission or early development appears to be a significant independent risk factor in predicing short term mortality in ACS.

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PROFORMA

Name of the investigator: Dr.G.ARAVIND

Place: Date:

PROGNOSTIC VALUE OF HYPONATREMIA IN PATIENTS WITH ACS

PROFORMA

NAME:

DOA:

AGE:

DOD:

IP NO.:

PRESENTING COMPLAINTS:

1. CHEST PAIN
2. BREATHLESSNESS
3. COUGH
4. PALPITATION
5. SYNCOPE
6. SWELLING OF LEGS/FACE
7. VOMITING/LOOSE STOOLS

RISK FACTORS:

DM

HTN

SMOKING

GENERAL EXAMINATION:

VITALS: BP:

PULSE:

RR:

JVP:

SYSTEMIC EXAMINATION:

CVS-

RS-

ABDOMEN-

CNS-

KILLIP CLASS-

INVESTIGATIONS:

RBS-

BLOOD UREA-

S. CREATININE-

SERUM SODIUM-

ADMISSION	48 HOURS	DISCHARGE

TOTAL CHOLESTEROL:

TRIGLYCERIDE:

TROPONIN T :

ECG-

ECHO-

DIAGNOSIS-

IN-HOSPITAL OUTCOME-

DISCHARGE STATUS-

FOLLOW UP TO 30 DAYS-

LIST OF ABBREVIATIONS

AMI	: Acute myocardial infarction
AVP	: Arginine Vasopressin
CAD	:Coronary Artery Disease
CCF	: Congestive Cardiac Failure
CK-MB	: Creatinine Kinase-MB
CVD	:Cardiovascular diseases
ECG	: Electrocardiogram
IHD	:Ischemic Heart Disease
LVF	: Left ventricular Failure
MR	:Mitral Regurgitation
TR	:Tricuspid Regurgitation
DM	:Diabetes mellitus
AWMI	:Anterior wall myocardial infarction
ASMI	:Antero septal myocardial infarction
IWMI	:Inferior wall myocardial infarction
RVMI	:Right ventricular myocardial infarction

S.No	AGE	SEX	DM	HT	SMOKING	PRIOR DIURETIC THERAPY	PRIOR CAD	EF	Na at ADMISSION	Na at 48 hours	Na at discharge	Troponin T	S.CHOLESTEROL	RBS	UREA	S.Creatinine	KILLIP CLASS	Diagnosis	In hospital outcome	Follow-up
1	46	M	N	N	Y	N	N	55	137	140	140	+	180	100	25	0.9	1	AWMI		A
2	43	M	N	N	N	N	N	60	138	139	141	+	190	105	27	0.8	1	IPWMI		A
3	50	F	Y	N	N	N	N	58	137	139	141	+	200	160	29	0.9	2	NSTEMI		A
4	53	M	Y	Y	Y	N	N	65	137	138	140	+	200	120	29	0.7	1	IWMI		A
5	58	M	Y	N	Y	N	N	45	137	138	139	+	230	122	27	0.8	2	AWMI	2*HB	A
6	46	M	N	N	N	N	N	60	138	139	140	+	176	160	25	0.7	1	AWMI		A
7	57	M	N	Y	N	N	N	42	137	136	138	+	190	98	35	0.8	2	AWMI		A
8	48	F	Y	Y	N	N	N	50	139	140	142	-	260	145	37	1.2	1	UA		A
9	36	M	Y	N	Y	N	N	68	137	138	137	+	200	180	34	0.7	2	AWMI		A
10	45	F	N	Y	N	N	N	55	139	140	141	-	180	140	31	0.9	1	UA		A

11	68	M	N	N	N	N	N	57	133	134	134	+	180	112	30	1	3	AWMI	CCF	A
12	67	F	Y	Y	N	N	N	49	137	136	138	+	190	300	25	1	1	AWMI		A
13	64	M	N	Y	N	N	N	48	137	133	132	+	250	120	23	0.9	1	IWMI		A
14	38	M	N	N	N	N	N	68	137	136	138	+	190	108	36	1.1	1	ASMI		A
15	61	M	Y	Y	N	N	N	40	136	134	133	+	245	200	20	0.8	1	IWMI		A
16	58	M	N	N	N	N	N	55	137	138	137	+	214	80	36	1	1	IPWMI		A
17	43	M	Y	N	Y	N	N	50	139	140	141	+	200	90	35	1	1	NSTEMI		A
18	48	F	Y	N	Y	N	N	41	128	130	127	+	183	154	33	1.1	2	AWMI	ACUTEMR	D
19	49	M	Y	Y	Y	N	N	36	129	130	129	+	250	210	22	0.9	1	IPWMI		D
20	58	M	Y	N	Y	N	N	68	137	139	140	+	177	124	28	0.8	1	AWMI		A
21	31	M	N	N	N	N	N	71	138	139	138	+	230	132	27	0.7	1	ALMI		A

22	32	M	N	N	N	N	N	52	136	137	139	+	170	107	25	0.8	1	AWMI		A
23	39	F	N	N	N	N	N	39	140	137	139	+	165	124	37	1.2	2	IWMI		A
24	46	M	Y	Y	N	N	N	42	129	130	128	+	186	170	23	0.7	1	IWMI		D
25	31	F	N	N	N	N	N	60	137	136	138	+	246	115	27	0.9	1	AWMI		A
26	52	M	N	Y	Y	N	N	30	136	137	140	+	200	150	30	0.9	2	AWMI	PE	A
27	50	F	Y	Y	N	N	N	55	138	139	140	+	200	260	32	1.1	1	AWMI		A
28	51	M	N	N	N	N	N	66	136	134	133	+	148	100	30	1	1	IWMI	VT	A
29	62	F	N	N	N	N	N	62	136	138	141	+	240	90	30	0.9	1	ALMI	2*HB	A
30	68	M	N	Y	Y	N	N	57	137	139	140	+	220	116	29	0.8	2	IWMI	PE	D
31	65	F	Y	N	N	N	N	49	141	140	141	+	150	220	24	0.7	2	AWMI	VT	D
32	57	F	Y	N	N	N	N	54	137	138	140	+	170	120	29	0.8	1	NSTE MI		A
33	44	M	N	N	Y	N	N	66	140	141	139	-	187	100	30	1	2	UA		A
34	39	F	N	Y	N	N	N	58	137	140	142	+	241	109	24	0.7	1	NSTE MI		A
35	43	F	N	N	N	N	N	62	140	139	140	+	165	99	29	0.6	1	NSTE		A

																		MI		
36	35	M	Y	N	Y	N	N	59	138	139	141	-	178	106	34	0.8	1	UA		A
37	59	F	Y	N	N	N	N	55	134	136	134	+	250	140	31	1	2	NSTE MI		D
38	40	M	Y	Y	Y	N	N	44	139	140	139	-	231	124	29	0.8	1	UA		A
39	30	M	N	N	N	N	N	47	136	132	133	+	200	108	35	0.7	1	AWMI		A
40	41	M	N	Y	Y	N	N	68	139	137	138	+	190	120	30	1.1	1	IRWM I		A
41	59	F	N	N	N	N	N	36	140	138	141	+	190	108	34	0.8	1	AWMI		A
42	45	M	Y	N	Y	N	N	52	135	133	134	+	220	250	29	0.9	1	AWMI		A
43	38	M	N	Y	Y	N	N	60	137	138	141	+	183	140	27	0.7	1	NSTE MI		A
44	71	F	Y	N	N	N	N	53	139	137	140	-	205	136	34	0.9	1	UA		A
45	49	M	Y	N	N	N	N	55	139	140	142	+	197	97	26	0.7	2	NSTE MI		A
46	34	F	N	N	N	N	N	58	137	135	133	+	200	80	29	0.8	1	AWMI		A

47	45	F	N	N	N	N	N	58	136	133	134	+	190	105	26	0.8	1	ASMI		A
48	76	F	Y	N	N	N	N	54	139	140	138	+	240	107	35	1.1	2	AWMI		A
49	30	M	N	N	Y	N	N	34	137	140	138	+	220	95	31	0.8	1	AWMI		A
50	60	F	N	N	N	N	N	55	134	136	138	+	181	100	35	0.9	1	IWMI	2*HB	A
51	37	M	N	N	Y	N	N	60	140	137	138	+	200	98	30	0.8	2	IPWMI		A
52	47	M	N	Y	Y	N	N	70	138	139	141	+	240	230	34	1.1	1	AWMI		A
53	39	M	N	N	Y	N	N	64	138	136	139	+	170	120	30	1	1	AWMI		A
54	42	M	Y	Y	N	N	N	42	140	137	138	+	200	140	25	1	1	ASMI		A
55	67	M	N	Y	Y	N	N	47	133	135	134	+	240	114	35	1.4	1	AWMI		A
56	44	F	N	Y	Y	N	N	52	137	140	139	+	200	104	28	0.7	1	AWMI		A
57	65	M	Y	Y	Y	N	N	30	137	134	132	+	190	110	34	1.2	2	AWMI	CCF	D
58	76	M	Y	N	Y	N	N	28	137	133	131	+	260	119	39	1.6	2	ASMI		D
59	58	M	N	N	Y	N	N	44	140	141	139	+	188	100	34	1.1	1	AWMI		A
60	55	M	Y	N	Y	N	N	60	137	149	140	+	157	168	39	1	1	NSTEMI		A

61	47	F	Y	Y	N	N	N	56	136	137	139	+	193	172	37	0.9	1	NSTEMI		A
62	33	F	N	N	N	N	N	50	138	140	141	-	176	119	29	0.8	1	UA		A
63	39	M	Y	N	Y	N	N	55	139	141	140	-	248	162	28	0.6	1	UA		A
64	62	M	N	N	N	N	N	48	135	137	140	-	216	171	32	0.8	1	UA		A
65	56	M	Y	Y	N	N	N	56	136	137	141	+	210	130	35	0.9	2	IPRWMI		A
66	38	F	N	Y	N	N	N	39	133	134	132	+	200	131	31	1	2	AWMI		D
67	62	M	Y	N	N	N	N	67	137	141	137	+	183	189	24	1	1	IPWMI		A
68	55	F	Y	Y	N	N	N	48	127	129	130	+	251	145	34	1.2	1	AWMI	VT	D
69	62	M	Y	Y	Y	N	N	44	140	140	139	+	226	99	35	0.9	1	AWMI		A
70	42	F	N	N	N	N	N	60	136	137	140	-	223	147	28	0.8	1	UA		A
71	50	M	N	N	Y	N	N	55	141	138	139	-	204	113	34	0.9	2	UA		A
72	39	M	N	Y	Y	N	N	51	139	140	139	+	187	94	26	0.7	1	NSTEMI		A

73	61	F	Y	Y	N	N	N	48	137	138	140	+	194	186	39	1	1	NSTE MI	A
74	49	M	Y	N	N	N	N	54	139	140	141	-	139	172	40	1.1	1	UA	A
75	38	M	N	N	Y	N	N	60	136	139	140	-	164	106	27	0.7	1	UA	A

INSTITUTIONAL ETHICS COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Protocol ID. No. 5/2016 Dt: 04.04.2016
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval " **Prognostic value of hyponatremia in patients with acute coronary syndrome** " - For Project Work submitted by **Dr.G.Aravind**, MD General Medicine, Govt. Kilpauk Medical College, Chennai – 10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

DEAN, 2/6/16
Govt.Kilpauk Medical College,
Chennai – 10.